Body Embodiment Impact on Cognitive Ability

Sabrina Song, Marcos Hernández, Yumi Omori, Tinh Ngo and Gulsim Azirakhmet

Introduction

Virtual Reality (VR) has the potential to create a sense of body ownership over an artificial body (Botvinick and Cohen, 1998). This sense of ownership can influence how individuals perceive themselves, enhancing mood and promoting perspective-taking (Osimo et al., 2015). Building on this, the study Virtually Being Einstein (Banakou et al., 2018) explores whether embodying a high-cognitive-ability individual in VR can improve cognitive performance. Our pilot study aims to replicate this experiment with modifications, including expanding the participant pool to include female participants and allowing avatar gender selection to enhance embodiment.

Participants

A total of 8 NYUAD students (5 male, 3 female, aged between 20 and 24 years old) took part in this experiment.

Procedures

Our pilot was conducted over two visits:

- First Visit: Participants received a briefing about the experiment and complete three assessment tests: the Tower of London (TOL), the Age Implicit Association Test (IAT), and a pre-experiment survey.
- Second Visit (Two Days Later): Participants were randomly assigned to one of two groups: the Scientist Avatar group (Albert Einstein or Marie Curie) or the Normal Avatar group (Male or Female). After completing a VR task involving arranging numbers in descending order, participants took the assessment tests again and completed a post-experiment survey addressing their VR experience.

Preliminary Results

Participants' performance varied depending on the avatar they embodied for the VR task. The average error count and time spent on the task highlight differences in cognitive engagement or efficiency, potentially influenced by the chosen avatar's identity. In the TOL assessments, participants showed a decrease in mean total scores from 33.38 (preTOL) to 30.63 (postTOL). However, there was an improvement in cognitive efficiency, as reflected in reduced mean solution time (12,358 ms preTOL to 9,971 ms postTOL) and execution time (5,511 ms preTOL to 4,713 ms postTOL). These results suggest that embodying high-cognitive-ability avatars like Albert Einstein or Marie Curie in VR may enhance cognitive efficiency, despite the observed decline in task accuracy. Further analysis could explore the underlying factors influencing these patterns, such as avatar identity and participant engagement.

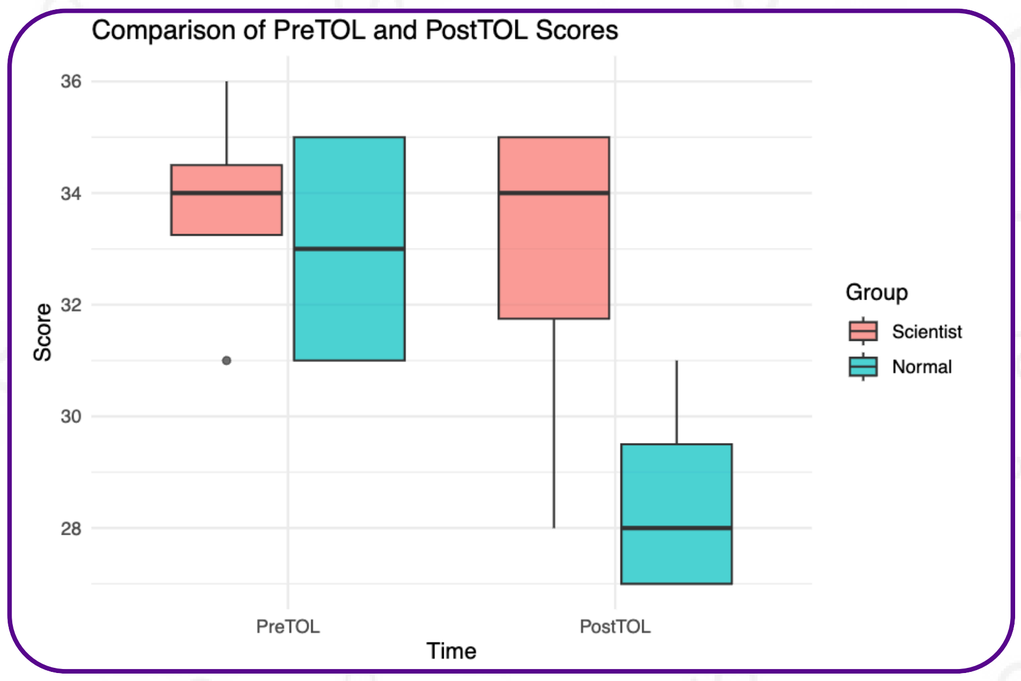

Figure 1. Comparison of PreTOL and PostTOL Scores.

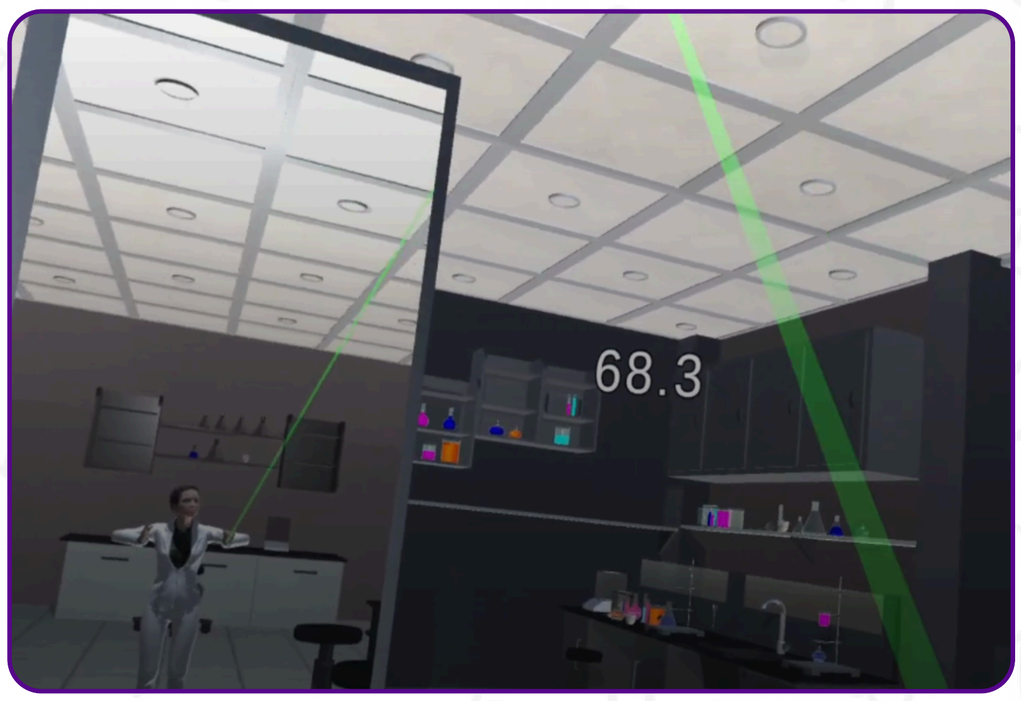

Figure 2. Inside the Virtual Reality experiment. The user embodies Marie Curie.

Discussion

This pilot study demonstrates that embodying high-cognitive-ability avatars, such as Albert Einstein or Marie Curie, in virtual reality can influence cognitive performance, improving efficiency as seen in reduced solution and execution times, though accuracy (total scores) slightly declined [1]. These results suggest that VR embodiment impacts cognitive processing and self-perception, but further research is needed to refine these insights. Future steps include expanding the participant pool for diversity, refining avatar design to assess the influence of realism and gender, and incorporating a broader range of cognitive tasks to examine effects across different processes.

References

1. Banakou, D., Kishore, S., Slater, M. “Virtually Being Einstein Results in an Improvement in Cognitive Task Performance and a Decrease in Age Bias.” Frontiers in Psychology, vol. 9, June 2018, https://doi.org/10.3389/fpsyg.2018.00917.
2. Botvinick, Matthew, and Jonathan Cohen. “Rubber hands ‘feel’ touch that eyes see.” *Nature*, vol. 391, no. 6669, Feb. 1998, p. 756. https://doi.org/10.1038/35784.
3. Osimo, Sofia Adelaide, et al. “Conversations between self and self as Sigmund Freud—A virtual body ownership paradigm for self counselling.” Scientific Reports, vol. 5, no. 1, Sept. 2015, https://doi.org/10.1038/srep13899.

Contributions

Gulsim Azirakhmet — Data analysis and character models.
Yumi Omori — Level design.
Marcos Hernández — Programming and level design.
Sabrina Song — Data analysis.
Tinh Ngo — Programming and character models.

Contacts

ga2219@nyu.edu
yd2247@nyu.edu
mdh8552@nyu.edu
sys8925@nyu.edu
tpn6059@nyu.edu

جامعة نيويورك ابوظبي
NYU ABU DHABI